HEATING DEVICE

FIELD OF THE INVENTION

The invention relates to a heating device with at least two plate-like ceramic heating elements electrically contacted on opposite flat sides, at least one flat electrical conductor being provided on at least one side.

BACKGROUND OF THE INVENTION

Devices according to the preamble are e.g. known from EP 379 837 A1 and EP 340 550 B1.

In both cases the electrical heating elements are in an insulating frame, preferably made from plastic, to which is integrated or connected in fixed form a lamellar electrical conductor which directly contacts the heating elements. This arrangement is in the first case formed from a casing in the form of a U-shaped removal part, whose U-shaped legs directly contact the other side of the heating elements, and an insulating strip placed on the conductor. Pressing results from lamellae mounted on said casing. In the second document the casing is constituted by an electrically conductive profile tube, in which is placed the contact arrangement of PTC elements, conductors and insulating strips thereon, after which the casing is pressed. In said heating devices according to the preamble a joint action takes place on all the heating elements.

DE 199 33 013 discloses a heating device with plate-shaped heating elements, which in the extension direction of the heating elements and also the contacting conductor has two separately switchable heating zones. However, for this purpose the heating conductors have to be contacted from two front sides of the device or in each heating zone part of the heating elements must be omitted, so that the heating density or specific heating power is unnecessarily reduced.

Therefore the problem of the invention is to so further develop the heating devices according to the preamble that with an optimum, specific heating power all the heating zones only have to be contacted from one front side.

SUMMARY OF THE INVENTION

According to the invention the set problem is solved by a heating device of the aforementioned type, which is characterized in that on one side of the heating elements are provided in electrically insulated manner from one another at least two conductors and each of the conductors is in contact with at least one heating element.

Thus, according to the invention substantially parallel and mutually insulated lamellar electrical conductors are provided, which are contactable on one side, in which the first conductor leads to at least one first heating element or to a first group of heating elements, a further conductor guided on said remote side of the first conductor and parallel thereto leads to at least one second heating element or a second group of heating elements, a third conductor possibly located on said remote side of the second conductor leads to at least one third heating element or a third group of heating elements and so on, and in this way

each conductor is electrically insulated from the further heating elements or groups of heating elements in the same way as the first conductor relative to the second and third heating elements or groups thereof, etc.

Contacting of the heating elements by the conductors can take place directly or indirectly. In the case of direct contacting the further conductor or conductors, apart from the first conductor, are offset towards the heating elements. Indirect contacting can take place by means of at least one electrically conductive spacer between the conductor plane and the contact surface of the heating element facing the same or several conductive spacers or a spacer and a contact plate. According to further preferred developments of the invention, the heating elements, conductors and optionally spacers are pressed in the casing and the latter is in particular given an electrically conductive construction and at least one flat side of the casing is in electrical contact with the flat side of at least one heating element remote from the at least one conductor.

BRIEF DESCRIPTION OF THE DRAWINGS

Further advantages and features of the invention can be gathered from the following description of embodiments of the invention, the claims and the attached drawings, wherein show:

Fig. 1 A perspective view of a radiator with heating devices according to the invention.

Fig. 2 In side view two inventively obtainable heating zones of the radiator of fig. 1.

Fig. 3 A side view of an inventive heating device.

Fig. 4 A larger scale representation of the connection details of an inventive device.

Fig. 5 A longitudinal section through a first embodiment of the heating device according to the invention.

Fig. 6 A longitudinal section through another embodiment of the inventive heating device.

Fig. 7 A longitudinal section through a third embodiment of the inventive heating device.

DETAILED DESCRIPTION OF THE DRAWINGS

Fig. 1 perspectively shows a radiator R comprising four individual heating devices 1 according to the invention. The individual heating devices 1 are interconnected by crossbars 10. Besides the heating elements, holding and insulating elements, which are shown and explained relative to figs. 5 to 7, the casing 2 of the inventive heating device 1 constructed in profile tube form, together with conductors 5.1, 5.2 and which are constructed as flat plates and project from the casing 2 are provided. The precise structure and interaction with the heating elements is also described in greater detail hereinafter relative to figs. 5 to 7.

Through the construction shown and described relative to figs. 5 to 7 it is possible with a radiator R formed from inventive heating devices 1 to create two heating zones (zones 1 and 2), in the manner shown in fig. 2, which can be switched separately from one another, so that either only zone 1, or only zone 2, or both zones are heated.

Fig. 3 is a plan view of an inventive heating device 1 with a casing 2, as well as the conductors 5.1 and 5.2 projecting therefrom. A larger scale representation of the end region of a heating device 1 or detail A of fig. 2 is shown in fig. 4.

The inventive heating device 1 has a casing 2, which is made from good heat transmitting material and preferably metal. The casing 2 can be a tube, preferably a profile tube, with a cross-section adapted to the internal structure 3 of the device. The upper and lower surfaces are preferably pressed convexly (concavely to the outside) inwards against the inner structure 3 of the device.

The inner structure 3 of the heating device 1 according to the invention has, from bottom to top in the embodiment shown, firstly an insulating strip 4, which rests on a lower cover surface 2a of the casing 2 within the same. From a front side 2c of the casing extends a lamellar, electrical conductor 5.2 with an end 5.2a projecting from the casing 2.

Spaced from the conductor 5.2 and above the same in the embodiment shown, are provided two plate-like, ceramic heating elements 6.1 and 6.2, which engage directly with a flat side 6.1a, 6.2a on the upper cover surface 2b of the casing. On its lower surface 6.1b remote from the cover surface 2b, the first heating element 6.1 is contacted by a further lamellar, electrical conductor 5.1, whose end 5.1a is passed out of the casing 2 on the same side as the electrical conductor 5.2. For insulating the two conductors 5.1 and 5.2 and for bridging the distance between them, an insulating spacer 7.1 is provided between them in the vicinity of the heating element 6.1.

In the vicinity of the second heating element 6.2, between the latter and the second electrical conductor 5.2 in the embodiment shown, is provided a contact plate 5.3 and an electrically conducting spacer 7.2. The front sides of the casing can be moulded and, as stated, the ends 5.1a and 5.2a of the two conductors 5.1 and 5.2 are passed out of the front side of the casing.

Thus, the first heating element 6.1 and the second heating element 6.2 can be separately supplied with voltage from a single front side of the casing 2 and can in this way be heated. In place of a first element 6.1 and a second element 6.2, as shown in the drawing so as not to overburden the same, there can also be several first heating elements 6.1 and several second heating elements 6.2, which can be separately contacted in the same way and supplied with voltage. There can also be more than two separately contacted and voltage-suppliable, individual heating elements or several corresponding groups of heating elements (e.g. three or more), and for this purpose, e.g. on the side of the second conductor 5.2 remote from the heating elements, a third heating conductor is passed in insulated manner within the casing 2 to the connection side (at 5.1a, 5.2a) and on the side remote from the connection side is in electrically conductive contact with one or more heating elements.

Both the conductor 5.1 and the contact plate 5.3 are held in a central free space of a frame 9 and in particular the conductors can be moulded in or moulded round by the frame 8, which projects vertically over the conductor 5.1 and contact plate 5.3 with respect to the flat sides thereof and in this way also surrounds and positions the heating

elements 6.1 and 6.2, together with the spacers 7.1 and 7.2.

The further conductor 5.2 can also be enclosed in such a frame.

The structure of the heating devices 1 of figs. 6 and 7 is fundamentally similar and in the vicinity of the first heating element 6.1 identical to the structure of the heater of fig. 5. The construction according to fig. 6 differs from that of fig. 5 in that the second conductor 5.2 in the vicinity of the second heating element 6.2 is offset towards the latter, so that it is only necessary for there to be one spacer 7.2' between the offset area 5.2b of the second heating conductor 5.2 and the insulating strip 4. The spacer 7.2' can be conductive or non-conductive and is preferably non-conductive. Preferably the spacer 7.2' forms a constructional unit with the insulating strip 4 and is made in one piece, e.g. from moulded ceramic. Advantageously there is a further reduction in component numbers.

In the variant of fig. 7 the contact plate 5.3 and electrically conductive spacer 7.2 of fig. 5 are replaced by a one-piece, electrically conductive spacer 7.2", which can also be moulded in the holding frame 8. The resulting construction is particularly preferred, because it combines the advantages of reducing the number of components with a simple implementation during manufacture.